Assessing Latent Level Associations Between PTSD and Dissociative Factors: Is Depersonalization and Derealization Related to PTSD Factors More So than Alternative Dissociative Factors?

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Assessing latent level associations between PTSD and dissociative factors: Is depersonalization and derealization related to PTSD factors more so than alternative dissociative factors?

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Abstract

Posttraumatic Stress Disorder (PTSD) criteria in DSM-5 included a dissociative diagnostic subtype characterized by a depersonalization item and a derealization item. Researchers have queried whether this was too restrictive as alternative dissociative symptomatology may also be characteristic of the subtype. The current study utilized data from 318 Northern Irish students, of which 165 were trauma exposed. Participants were assessed for PTSD symptomatology based on DSM-5 criteria via a modified version of the PTSD Symptom Scale-Self-Report (PSS-5) and dissociative experiences via the Dissociative Experiences Scale (DES). Confirmatory factor analysis of PTSD and DES models revealed an optimal 4-factor DSM-5 PTSD model including re-experiencing, avoidance, negative alterations in mood and cognitions, and alterations in hyperarousal and re-activity factors, and an optimal 3-factor DES model including absorption, amnesia, and depersonalization /derealization factors. When comparing the correlations between depersonalization /derealization and the four PTSD factors, significant Wald tests of parameter constraints revealed that depersonalization /derealization is more related to alterations in arousal and re-activity (r=.432) compared to avoidance (r=.289), $\chi 2$ (1, N = 165) = 8.352, p =.004. We discuss whether the mechanism for comorbid PTSD and dissociation may be related to PTSD's arousal factor.

Keywords: Confirmatory Factor Analysis; Posttraumatic Stress Disorder; Dissociation; *DSM-5;* Dissociative Experiences Scale

Introduction

The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) released in May 2013 introduced a number of revisions to the Posttraumatic Stress Disorder (PTSD) diagnostic criteria. Revisions included an amendment to the definition of a traumatic exposure, revisions to existing symptom descriptions, the addition of symptoms, the grouping of symptoms into four rather than three symptom clusters, and the inclusion of a dissociative PTSD subtype characterized by the endorsement of depersonalization and derealization symptoms (cf. Friedman, Resick, Bryant, Strain, Horowitz et al., 2011). The latter two revisions are of central focus in the current study.

Trauma exposure, PTSD, and dissociation have long been associated. The theory which relates traumatic experience to the development of dissociative psychopathology dates back to the work of Janet (1907) and Breuer and Freud (1895). More recently, it has been suggested that dissociative symptomatology, both peri- and post-trauma, functions to minimize the negative emotional reactions to traumatic exposure (Putnam, 1989; Spiegel, 1991; van der Kolk and van der Hart, 1989). Subsequent empirical research has shown that dissociative symptomatology develops in response to traumatic experience (cf. Gershuny & Thayer, 1999) and that peri-traumatic dissociation is one of the strongest risk factors for the subsequent development of PTSD (Ozer, Best, Lipsey, and Weiss, 2003). Indeed, peri-traumatic dissociation has been highlighted as a salient predictor for both posttraumatic symptoms and PTSD in two meta-analyses; one of studies conducted between 1980-2000 (Ozer et al., 2003) and the other of studies conducted between 1995-2004 (Breh and Seidler, 2007). Early traumatic responding in the form of Acute Stress

Disorder (ASD) requires participants to endorse three of four (numbing/detachment, reduced awareness of surroundings, derealization, and depersonalization) dissociative symptomatology. Additionally, PTSD symptoms in the form of flashbacks and amnesia are considered dissociative.

To date, much of the work assessing the role of dissociation in PTSD's symptomatology has focused on peri-traumatic dissociative experiences. This differs from the dissociative experiences outlined in the DSM-5 for the dissociative PTSD subtype which is characterized by persistent dissociative experiences. Peri-traumatic and persistent dissociative experiences have been shown to be correlated at .25 (Tichenor, Marmar, Weiss, Metzler, and Ronfeldt, 1996), and therefore one must be careful when generalizing findings based on studies of peri-traumatic dissociation to matters of persistent dissociation.

The DSM-5 dissociative PTSD subtype was proposed and has subsequently been supported based on both clinical and neurobiological evidence (Armour, Karstoft, and Richardson, in press; Cloitre, Petkova, Wang, and Lassell, 2012; Ginzburg, Koopman, Butler, et al., 2006; Lanius, Brand, Vermetten, Frewen, and Spiegel, 2012; Lanius, Vermetten, Loewenstein, et al., 2010; Resick, Suvak, Johnides, Mitchell, Iverson, 2012; Spiegel, Loewenstein, Lewis-Fernandez, Sar, Simeon D, Vermetten, et al., 2011; Steuwe, Lanius, and Frewen, 2012; Wolf, Miller et al., 2012; Wolf, Lunney et al., 2012). Researchers initially proposed that the dissociative PTSD subtype be characterized by the presence of only depersonalization and derealization symptoms of dissociation (cf. Lanius et al., 2011). However, one study conducted by Armour, Elklit, Lauterbach, and Elhai (in press) highlighted that an additional indicator of dissociation (reduced

awareness) was the dissociative item most associated with overall PTSD (r = .57), in addition to being the item most likely to be endorsed by members of the dissociative PTSD class compared to the depersonalisation and derealisation items. This raised questions as to whether a wider range of dissociative symptomatology may be indicative of the subtype.

PTSD's Factor Structure (DSM-III to DSM-IV-TR).

The underlying dimensionality of PTSD has been contended within the literature. Since PTSD's initial inclusion the DSM has categorized PTSD symptoms into three distinct symptom groupings; re-experiencing, avoidance/numbing, and hyperarousal (APA, 1980; APA 1987; APA, 2000). Generally speaking, each of the symptom groupings are proposed to have distinct yet somewhat related functions. Re-experiencing symptoms are thought to occur as an attempt at integrating trauma memories with pre-existing knowledge. Avoidance/ numbing symptoms attempt to avoid trauma-related stimuli with the aim of avoiding the distressing re-experiencing symptoms. Avoidance of trauma-related stimuli is assisted by hyperarousal symptoms, as hyperarousal increases an individual's vigilance for exposure to such stimuli (reviewed in Brewin and Holmes, 2003).

Despite a comprehensive theoretical grounding for the tripartite model of PTSD, empirical support largely lies with alternative model conceptualizations (reviewed in Yufik and Simms, 2010; Elhai and Palmieri, 2011). Indeed, plentiful support has been found for the Emotional Numbing model (King, Leskin, King, and Weathers, 1998), the Dysphoria model (Simms, Watson, and Doebbeling, 2002), and a more recently proposed five factor model; the Dysphoric Arousal model (Elhai, Biehn, Armour, Klopper, Frueh

et al., 2011). When comparing the Emotional numbing model and the Dysphoria model the latter was deemed optimal in a meta-analysis of 40 PTSD studies (N = 14,827 participants) (Yufik and Simms, 2010). Of note, the Dysphoric Arousal model (Elhai et al., 2011) has been the recipient of support from the most recent of factor analytic studies (cf. Armour, Ghazali, and Elklit, 2013; Armour, O'Conner, Elklit, and Elhai, 2013; Harpaz-Rotem, Tsai, Pietrzak, and Hoff, 2014; Reddy, Anderson, Liebschutz, and Stein, 2013; Semage et al., 2013; Wang, Armour, Li, Dai, Zu, and Yao, 2013; Wang, Cao, Wang, Zhanga, and Li, 2012).

PTSD's Factor Structure (DSM-5).

The DSM-5 (APA, 2013), published in May of 2013, now includes 20 rather than 17 PTSD symptoms, with some of the original 17 symptom descriptions being revised. Most pertinent to the focus of the current study, the 20 symptoms are now categorized across four rather than three symptom groupings; 1) re-experiencing, 2) avoidance, 3) negative alterations in mood and cognitions (predominately numbing symptoms with the addition of three symptoms; a) persistent negative expectations about oneself, others, or the world, b) persistent distorted blame of self or others about the cause or consequences of the trauma, and c) pervasive negative emotional states) and 4) alterations in arousal and reactivity (predominately hyperarousal symptoms with irritability/anger and the addition of a symptom of reckless behavior) (cf. Friedman et al., 2011). This model conceptualization is closest to that of the DSM-IV-TR's Emotional Numbing model noted above. An alternative DSM-5 Dysphoria model has been put forth to represent the DSM-IV-TR Dysphoria model; this model includes an eight item Dysphoria factor (see Table 1 for item mappings of both models). The DSM-5 model has garnered the most

empirical support to date; particularly in studies comparing it to the alternative DSM-5 Dysphoria model (Biehn et al., 2013; Contractor, et al., 2014; Elhai et al., 2012).

Dissociative Experiences Scale Factor Structure

The Dissociative Experiences scales (DES; Bernstein and Putman, 1986) is arguably one of the most widely used measures of dissociative phenomenon in both clinical and community based populations (van Ijzendoorn and Schuengel, 1996). Notable criticisms of the measure have however been highlighted; one in particular pertains to the variability with which studies report the DES's underlying dimensionality. Bernstein and Putman (1996) originally reported three underlying item groupings; 1) absorption, 2) depersonalization /derealization and 3) amnesia. Absorption is characterized by a state of focused attention in which individuals become fully immersed in their own thoughts, for example DES absorption items query whether individuals have become completely absorbed in a story or found themselves staring off into space, thinking of nothing, and being unaware of time. Depersonalization and derealization are characterized by a state of un-connectedness with both the individuals self and the world around them, for example DES depersonalization and derealization items query whether individuals have looked in a mirror and felt that they did not recognize themselves and whether they feel that they are looking at the world through a fog. Amnesia represents memory impairment, DES amnesia items query if individuals report having no memory for important events or finding themselves in a certain place with no memory of how they got there. A number of studies have subsequently agreed that a three factor model best represented their DES data; however the items which load on each of the three factors have not always been consistent (Ross, Joshi, and Currie 1991, Ross, Ellason, and

Anderson, 1995; Ruiz, Poythress, Lilienfeld, and Douglas, 2008; Sanders and Green 1994; Stockdale, Gridley, Ware and Holtgraves, 2002). Moreover, a number of studies have reported alternative model conceptualizations comprising 1, 2, 4, and 7 factors (cf. Dunn, Ryan, and Paolo, 1994; Fischer and Elnitsky, 1990; Holtgraves and Stockdale 1997; Ray and Faith 1995; Olsen, Clapp, Parra, and Beck, 2013). Stockdale et al. (2002) additionally assessed two bi-factor (hierarchical) models; however these were shown to have poorer fit compared to 2-, 3-, and 4-factor inter-correlated models.

Notably, much of the factor analytic work has been exploratory rather than confirmatory in nature with the exception of a few studies (Ruiz et al., 2008; Stockdale et al., 2002; Olsen et al., 2013). An issue which is thought to further compound the consistency of results is the variability across studies in regard to the characteristics of their samples, in particular with regard to differences related to trauma exposures. Studies to date have focused on combat veterans reporting PTSD, trauma-exposed offenders (Ambdur and Liberzon, 1996; Ruiz et al, 2008) and samples of college students (e.g., Sanders and Greene, 1994; Olsen et al., 2013). Moreover, the clinical profiles of samples have also greatly varied; some are comprised of PTSD diagnosed participants (Ambdur and Liberzon, 1996) whereas others are comprised of individuals diagnosed with multiple personality disorder (Ross et al., 1995). Studies to date generally support a model comprising three factors of 1) absorption, 2) depersonalization and derealization, and 3) amnesia (cf. Stockdale te al., 2002). Notably however the most recent of CFA studies on DES items supported a 2 factor model of 1) absorption and 2) amnesia/depersonalization.

Current Study

When researchers wish to compare the relationships between underlying groupings of disorders one analytic strategy is to first assess factor analytical models of the disorders and then assess the latent-level associations between groupings. Examples of such studies include those assessing the latent-level associations between PTSD and depression factors with a view to clarifying the comorbidity mechanism (Biehn, et al., 2013; Elhai, Contractor et al., 2011; Contractor, Durham et al, 2014). To date however, no study has utilized the same analytic techniques to assess the latent-level relationships between PTSD and dissociation; this is the focus of the current study.

The current study aimed to 1) assess the fit of competing DSM-5 PTSD models, 2) assess the fit of competing Dissociation models (using DES items), and 3) assess the latent-level relationships between the latent factors of the optimal PTSD and DES models in a combined model CFA. In doing so, we hoped to provide clarification on which factors may best count for the relationship between PTSD and Dissociation. This line of enquiry is pertinent given the recent inclusion of a dissociative PTSD subtype in the DSM-5 nosology.

Method

Participants and procedure

The current study is based on a convenience sample which consisted of 318 Northern Irish university students. Participants were approached on multiple campuses either during lecture breaks or in the campus library. All data were collected during the first academic semester (September – December) of the 2013/14 academic year. Participation was entirely voluntary, and informed consent was given by all participants.

Ethical permission for data collection was approved by a university ethics board as part of a larger data collection project.

Measures

Stressful Life Events Screening Questionnaire (SLESQ: Goodman, Corcoran, Turner, Yuan, and Green, 1998). The SLESQ assesses 12 traumatic experiences which qualify as Criterion A1 traumatic stressors as outlined in the DSM-IV. To ensure that the traumas queried were representative of the new DSM-5 trauma definition we queried whether the 'witnessed exposure item' and the 'extreme exposure to gruesome or horrific details of trauma' were witnessed exclusively through electronic media. For the latter we also queried whether 'extreme exposure to gruesome or horrific details of trauma' was part of the individual's occupational role. By using these qualifiers we ensured that only individuals reporting trauma as defined by the DSM-5 were used in subsequent analysis. Previous studies have utilized this version of the SLESQ (c.f Biehn et al., 2013; Elhai, Miller, et al., 2012).

PTSD Symptom Scale-Self-Report (PSS-SR: Foa, Riggs, Dancu, and Rothbaum, 1993). The PSS is a self-report measure of the 17 PTSD items found in the DSM-IV-TR nosology. Items are rated using a 4 category response format (0 "Not at all" to 3 "5 times or more per week/very much/almost always"). The measure used in the current study is a modified version of the original PSS-SR which was first used in a study by Elhai, Contractor et al. (2012). The PSS-SR was modified to reflect the DSM-5 criteria of PTSD, thus items reflecting a pervasive negative emotional state, excessive trauma-related blame, reckless behavior, and a negative perception of either oneself, the future or the world were added. Previous studies conducted on the original version of the PSS-SR

have reported that internal consistency ranges from .66-.71, with test-retest reliability of .66-.77 (Foa and Tolin, 2000). Contractor et al. (2014) implemented the modified measure used herein and reported an alpha coefficient of .96, which was identical to the internal consistency of the modified PSS-SR in the current study.

Dissociative Experiences Scale (DES: Bernstein and Putnam, 1986). The DES is a self-report measure of 28 items. Items are rated using a 11 category response format (0 '0%' to 10 '10%'). The measure was originally developed as a screening measure for dissociative disorders; however it has since been utilized within both non-clinical and clinical samples (Ijzendoorn and Schuengel, 1996). Bernstein and Putnam (1986) reported that the internal consistency of the DES was high (.83-.93). Test-re-test reliability has also been evidenced (.78-.84) (Carlson and Putnam, 1993). The internal consistency of the DES in the current study was high (alpha = .93).

Missing Data

A total of 318 responders completed the survey; of those 202 endorsed a DSM-5 defined Criterion A trauma. An investigation into the item level-missing data across the PTSD items revealed that 35 participants were missing over 70% of the PSS items reducing the sample to 167 participants. An examination of the 167 cases revealed that 2 of these cases were missing over 70% of DES items so were removed from the sample. Thus, the effective sample size consisted of 165 trauma exposed participants. The remaining nominal amounts of missing data from the PSS and DES items were treated within the Mplus 6.1 software using maximum likelihood (ML) procedures (Graham, 2009).

Analyses

All analyses were conducted using MPlus 6 software. The analyses were conducted in three steps. Step one implemented testing the fit of PTSD's competing models using the 20 PSS-SR items which reflect DSM-5 PTSD diagnostic criteria. Two four-factor models were specified and estimated; 1) a DSM-5 dysphoric model and 2) the DSM-5 model (See Table 1). PSS-SR items have four response options therefore were treated as ordinal indicators within the CFA. When estimating ordinal indicators CFA uses a polychoric covariance matrix, the robust weighted least squares, with a mean- and variance-adjusted chi-square (WLSMV) and probit regression coefficients (Flora and Curran, 2004). In addition, error covariances were fixed to zero and the variances of the latent factors were fixed to one. Of note, these models were re-estimated using the maximum likelihood estimator (ML) to achieve Bayesian Information Criterion (BIC) values to allow comparison between the two non-nested models. Chi square difference testing is only appropriate when models are nested.

Step two also implemented testing competing models CFA, this time utilizing 28 indicators from the Dissociative Experiences Scale (DES). Four competing models were specified and estimated; 1) a single factor model, 2) a two factor absorption and amnesia model, 3) a three-factor absorption, amnesia, and aepersonalization /derealization model, and 4) a four factor deprsonalization/derealization, absorption, distractibility, and memory disturbance model (See table 2). DES items have 10 response options therefore were treated as continuous indicators within the CFA. When estimating continuous indicators CFA uses the ML estimator. ML estimation has however been shown to inflate chi-square statistics and thus bias the fit of the model under conditions of non-normality (Curran, West, and Finch, 1996). Given extreme violations in normality on the DES

indicators the models were estimated using the robust maximum likelihood (MLR) estimator which includes a correction factor to adjust the chi-square to account for non-normality (Satorra and Bentler, 1994). In the DES models, error covariances were also fixed to zero and the variances of the latent factors were fixed to one.

Please insert tables 1&2 here

Step three implemented Wald Chi-square tests to assess the latent-level relations between PTSD's optimal model and the optimal model of the DES indicators. Both optimal CFA models were specified and estimated in a single model which allowed for the assessment of correlations between all PTSD and DES factors. Wald chi-square tests of parameter constraints assessed (1) whether a particular DES model factor was more or less related to the PTSD model factors and (2) whether a particular PTSD model factor was more or less related to the DES model factors. For example, we tested whether Absorption was more or less related to Re-experiencing compared to Avoidance.

Optimal model selection in steps one and two rely on CFI and TLI values equal to or greater than .95 (.90–.94), and RMSEA values equal or greater than .06 (.07–.08). Models which meet these specifications are generally deemed as adequate (Hu and Bentler, 1999). As noted above the BIC also assists in model selection with lower values being preferential. Indeed a 10 point difference in BIC values is indicative of very strong support for the model with the lowest value (Kass and Raftery, 1995). In step three, a significant Wald chi-square test ($p < .05$) indicates that the two pairs of correlations differ from 0 and thus are significantly different.

Results

Demographics of Effective Sample

The majority of participants were female (*n* = 133; 80.6%) and ranged in age from 18 to 48 (M = 23.07, SD = 6.88); [29 were >25]) and were predominantly Caucasian (*n* = 164; 99.4%). Almost half of the Caucasian participants nominated themselves as white British (*n* = 80; 48.5%). The remaining students nominated themselves as either white Irish (*n* = 30; 18.2%) or white other (*n* = 54; 32.7%). All participants were current university students. Details pertaining to trauma exposures are presented in Table 3. The most frequently endorsed trauma within the current sample was 'Has an immediate family member, romantic partner or very close friend died as a result of accident, homicide, or suicide?' (*n = 79*; 47.9%) followed by 'physical violence' (*n* = 55; 33.3%). Mean PTSD symptom cluster scores in the effective sample were 3.84 (*SD* = 7.32), 1.81 (*SD* = 3.13), 4.30, (*SD* = 5.35), 4.01 (*SD* = 7.21) (re-experiencing [range = 0-73], avoidance [0-33], negative alterations in mood and cognitions [0-32], and alterations in arousal and re-activity [0-78], respectively). Probable PTSD based on meeting trauma endorsement criteria and positive endorsement of all 4 PTSD symptom clusters was met by 13.3% (*n* = 21) of the sample. Of note a further 13.3% (*n* = 21) met three of four PTSD symptom clusters.

Please insert Table 3 approx. here

CFA Results: PTSD model and Dissociation model

The *DSM-5* PTSD model fit the data well, as did the alternative DSM-5 Dysphoria model. Notably the fit of these two models was almost identical in the current sample. When re-running the models using the MLR estimator to achieve BIC values these differed by only 1 point. Therefore, given that the DSM-5 model is current and has been supported across previous studies, this model was chosen for our analysis. Of the four models of the DES, the three-factor model (see table 2) provided the best fit to the data and thus was deemed the optimal model for use in subsequent analysis. Fit indices for competing PTSD models can be viewed in Table 4. Fit indices for competing Dissociation models can be viewed in Table 5.

Please insert Table 4 & 5 approx. here

Combined CFA model

The CFA model which simultaneously specified and estimated the optimal 4-factor DSM-5 PTSD model and the optimal 3-factor DES model fit the data well, χ^2 (1059) = 1360.057, p < .0001; RMSEA = .042; CFI = .926; TLI = .921. The inter-factor correlations between the four PTSD factors and the three DES factors were all positive and statistically significant ($p < .001$). Correlations are presented across tables 5 and 6.

Wald Tests of Parameter Constraint

When comparing the relation of each PTSD factor to depersonalization /derealization (DEP) and alternative DES factors, most Wald tests of parameter constraints revealed non-significant ($p>.01$) findings (see tables 6 and 7). Of note, when comparing the correlation between re-experiencing (RE) with absorption (AB) ($r=.432$)

compared to RE with amnesia (AMN) (r=.242), the Wald test of parameter constraint χ^2 (1, N = 165) = 12.664, p <.001 indicated that AB was more related to RE compared to AMN. Likewise, when comparing the correlation between alterations in arousal and reactivity (AR) with AB (r=.462) compared to AR with AMN (r=.302), the Wald test of parameter constraint χ2 (1, N = 165) = 7.776, p =.005 indicated that AB was more related to AR compared to AMN (See Table 6).

When assessing the latent-level relationships between DEP and the four PTSD factors, significant Wald tests of parameter constraints revealed that DEP is more related to AR (r=.432) compared to avoidance (AV) (r=.289), χ2 (1, N = 165) = 8.352, p =.004 (see Table 7). See Tables 5 and 6 for the results of all correlations and Wald's Chi-Square Parameter tests.

Please insert Table 6 and 7 approx. here

Given the reported relationship between DEP and AR we conducted post-hoc analysis to determine how each of the individual items of AR correlated with the DEP factor. All AR items significantly correlated with the DEP factor; Irritable/Angry (r = .336), Reckless Behavior (r = .376), Hypervigilance (r = .323), Easily Startled (r = .346), Difficulty Concentrating (r = .367), and Difficulty Sleeping (r = .231). All correlations were significant at the p < .001 level. When comparing pairs of correlations Wald tests of parameter constraints revealed no item of AR was significantly more or less related to DEP than others (p>.001).

Discussion

The current study utilized a university sample of 167 trauma exposed individuals. In general trauma exposure was high; 107 (64.8%) of participants endorsed two or more traumatic event exposures and 25 (15.2%) endorsed five or more traumatic event exposures. This is however not uncommon within the Northern Ireland population where trauma exposure is prevalent (cf. Bunting, Ferry, Murphy, O'Neil and Bolton, 2013). Overall, results suggest that alternative dissociative symptom groupings are neither more or less related to PTSD groupings compared to DEP; however differential relations exist in relation to how DEP associates with PTSD factors.

Neither of the two four-factor PTSD models were found to be superior to the other; therefore the DSM-5 model was used in further analyses in the current study. This decision was based on the findings of previous studies. For example, Elhai et al. (2012) reported that of competing models the DSM-5 four-factor model provided the best fit to their data. Additional studies also found superior fit for the DSM-5 model compared to the alternative DSM-5 Dysphoria model (cf. Biehn et al., 2013; Contractor et al., 2014); the former using a sample of undergraduate psychology students and the latter a primary care sample.

Of competing DES models, the three-factor model comprising an absorption, amnesia, and depersonalization / derealization factor provided the best fit to the data with some evidence for a four-factor solution (see Table 2). Superior fit of the three factor model concurs with previous research, for example with Stockdale et al. (2002) who investigated the factor structure of the DES in two samples of mid-western university students (N = 971 [69% female] & N = 400 [69% female]). Utilizing exploratory factor

analysis, on the sample comprising 971 students, Stockdale et al. (2002) reported three defensible solutions comprising one-, two-, and three- factors. A four-factor solution was also deemed defensible but less so given it produced a fourth factor comprising only two items and resulted in an Eigen value of 1.05 (close to the cut-off value of 1). Utilizing CFA, the four inter-correlated models were fit to the same data (N = 971). In addition, two hierarchical models were specified and estimated. Of these competing models, the three factor inter-correlated model was deemed optimal. To further validate the models, Stockdale et al. utilized the second sample of 400 undergraduate students and conducted a competing models CFA, again concluding that optimal fit was provided by the three-factor model which is supported in the current study. Of note, the poor fit demonstrated by the DES in this trauma exposed sample may be attributable to criticisms of the DES in that it is not particularly representative of trauma related dissociation, rather a number of items are said to represent either relatively common and minor experiences of dissociation found even in the absence of psychological disorder whereas others, admittedly, represent more severe experiences, however are primarily associated with dissociative disorders (Carlson et al., submitted; Dalenberg and Paulson, 2009).

The combined CFA models indicated that all correlations between PTSD and dissociative factors were positive and statistically significant. Correlations ranged from .242 (Re with AMN) to .462 (AR with AB). When focusing on the correlations between the DEP factor with PTSD factors, the correlations ranged from .289 (with AV) to .432 (with AR). All correlations are provided in tables 6 and 7. Given that PTSD and dissociation have long been associated we would expect that the latent factors of the two disorders would correlate. Furthermore, although we expect these to be related we would

not expect them to be highly correlated given they are essentially two distinct disorders. This is confirmed in the current study.

In assessing if alternative dissociative factors were more or less related to PTSD factors compared to DEP, results revealed that no alternative dissociative factor (AB or AMN) was more or less related to any of the four PTSD factors as compared to the DEP factor. This is contrary to what we would have expected given the emphasis on depersonalization and derealization items in the newly proposed dissociative PTSD subtype in the DSM-5 (cf. Lanius et al., 2011). Although not of central focus to the current study, it is notable that Wald chi-square tests of parameter constraints revealed that absorption was more related to AR and RE compared to AMN, despite there being an amnesia item included within PTSD's negative alterations in mood and cognitions (NAMC) factor. Notably however, CFA studies have often reported that the lowest factor loading across all items was the factor loading of memory impairment (cf. Armour, Carragher, and Elhai, 2013; Armour, Elhai, Richardson, Radcliffe, Wang, and Elklit, 2012).

In comparing correlations of DEP with PTSD factors, the current results indicated only one significant finding; that DEP was more related to AR (r =.432) compared to AV (r = .289). This is in part contradictory to results reported by Stein et al. (2013) who reported that among respondents meeting PTSD criteria, the presence of dissociation was positively associated with the number of re-experiencing symptoms, but not with the number of hyperarousal symptoms. This discrepancy across studies may in part be accountable to both re-experiencing and hyperarousal symptoms belonging to the fear/threat processing dimension of the PTSD phenotype rather than the distress

dimension. Thus both have commonalities and therefore it is reasonable that both may in some way be related to dissociation (Zoellner, Pruitt, Farach and Jun, 2013). Furthermore, alternative differences across study samples may increase or decrease the association of each with symptoms of dissociation. Notably however, previous research has reported that levels of arousal and dissociation are highly correlated (Moleman, van der Hart, and van der Kolk, 1992). Moreover, McFarlane (2013) states "The accumulated evidence is that dissociation is a regulatory strategy to deal with the intense hyperarousal that PTSD sufferers experience" (p.296). This is therefore supportive of the finding that DEP was more related to AR compared to AV. It is however important to acknowledge that although the results suggest a potential leading role for AR as it relates to DEP, we must stress that this is only based on an examination of inter-correlations between latent factors and only in comparison to AV. Indeed, AR was not significantly different in its relationship with DEP compared to both NAMC and RE (Albeit the latter would have been significant at the $p = < .05$ level). It is also important to acknowledge that we are comparing the depersonalization and derealization dissociative indicators specifically to DSM-5 PTSD groupings whereas Stein et al. focused their comparisons on the three PTSD symptom groupings comprising the 17 PTSD items from the DSM-IV-TR. Of note, given the aim of their study, dissociation represented only two depersonalization items and one derealization item rather than depersonalization / derealization (or indeed dissociation) more generally.

In conclusion, by assessing the inter-relations between PTSD and dissociation factors, the current study raises questions as to which dissociative items should be included in the diagnostic symptom set for dissociative PTSD. Indeed, Wald chi-square

tests of parameter constraints revealed that the DEP factor was no more or less related to any PTSD factor compared to alternative dissociative factors. The results did however highlight that AB was more related to PTSD factors compared to AMN which warrants further exploration. Interestingly, few differential relations between the DEP factor of dissociation and the four factors of PTSD were evident (i.e., a single significant finding that DEP was more related to AR (r=.432) compared to AV (r =.289), Wald $\chi 2$ (1, N =165)8.352, p=.004). The current results therefore provide tentative support that the mechanism for comorbid PTSD and dissociation may be related to PTSD's arousal factor.

Forensic & Clinical Implications

In Forensic mental health an important aspect related to PTSD is the identification of valid from non-valid cases (malingering). Historically, forensic cases related to PTSD and dissociation have been successfully concluded as acts of self-defense and related to diminished capacity; in fact some of the PTSD symptoms most related to criminal cases are dissociation and hyperarousal (Berger, McNigel, and Binder, 2012). Thus, given the addition of a dissociative PTSD subtype in the DSM-5 nosology, the current study's overarching aim, to assess PTSD and dissociations latent-level relations, is timely and important. In doing so, we have highlighted based on the inter-correlations between latent factors, that DEP items, as would be expected from the DSM-5 dissociative PTSD criteria, are perhaps not the only dissociative symptoms indicative of dissociative PTSD. Thus, patients presenting with a wide range of dissociative experiences should also be queried in relation to PTSD. In forensic cases, it would be also be helpful to assess for diversity of dissociative phenomena given its relation to different PTSD symptom

clusters in the current study. We highlighted that the mechanism for comorbid PTSD and dissociation may be related to PTSD's AR factor. If this proves to be the case, clinicians must be aware that those presenting with high levels of AR may also be experiencing dissociative symptomatology; which is known to associate with self-harm and sucidality (Foot, Smolin, Neft, and Lipschitz, 2008), and that this may be particularly prevalent in forensic populations (Hawton Linsell Adeniji Sariaslan, and Fazel, 2013). In fact, the current study results add to the idea that self-defence in forensic cases could be related to hyperarousal symptoms (e.g., poor impulse control and overestimation of danger) and dissociative flashbacks (Berger et al., 2012). The current study is also pertinent in the psychological injury context, e.g., disability claims, given that assessment using DSM-5 criteria will quickly become more prevalent.

Study Limitations

The current is the first, to our knowledge, to assess the latent-level relationships between groupings of PTSD and dissociative items. However, several limitations are present. First, we employed the use of data from university students and so are unable to determine if the current findings will generalize to alternative trauma-exposed samples. In line with this, the current study focused on only those who were trauma exposed resulting in a smaller sample size. It is important to note that larger samples with a more diverse trauma profile may reveal further associations between PTSD and dissociation factors. It is therefore important that the current study is replicated in alternative samples. In addition, although our sample is comprised of individuals who have endorsed criterion A traumas as per the DSM-5 stipulations, different result may be found in samples which focus on specific trauma exposures, for example rape and sexual assault victims, rather

than heterogeneous trauma exposures. Moreover, 13.3% of the current sample met the criteria for probable PTSD, results may differ in samples reporting a greater prevalence of PTSD. Indeed, Stein et al. (2013) reported that the prevalence of dissociative symptoms was increased in those with PTSD who reported sexual violence (19.9%) compared to those reporting alternative traumas such as the death of a loved one (13.0%). Second, we assessed trauma exposure, PTSD symptoms, and dissociative symptoms using self-report measures rather than via a clinical interview. Thus, the results may be biased to issues of socially desirable answering and issues with memory recall. Notably however, diagnostic concordance rates between the use of self-report measures and clinical interviews have been reported as high (Coffey, Dansky, Falsetti, Saladin, and Brady, 1998; Harrington and Newman, 2007). Similarly, we acknowledge the potential for sampling bias in this study given that interest in participation may be linked to students who identify with the area of research. We also acknowledge that we used a modified version of the PSS to encapsulate the DSM-5 criteria; as such we can evidence reliability of this measure but we not the validity. Third, the DES model used for latent-level comparisons provided poor fit to the data, albeit superior fit to alternative DES models. However, the model used has gathered previous support in two samples of university students (Stockdale et al., 2002) and thus was deemed the best option available to us.

To truly determine the latent-level associations between PTSD and dissociative symptom groupings, in particular the DEP grouping, this study should be replicated using both clinical samples and samples who present with alternative trauma profiles. Furthermore, researchers should endeavor to assess the temporal relationships between

these latent factors in an attempt to clarify whether certain factors drive the course of alternative factors. One option would be to determine if alterations in arousal and reactivity covary or not with depersonalization/derealization over time and during treatment. Given that we only assessed the inter-relations between latent factors of PTSD and dissociation, an additional line of enquiry would be to ascertain the predictive value of individual dissociative indicators as they relate to the dissociative PTSD subtype.

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Table 1.

PSS-SR Item Distribution across PTSD Models.

DSM-5 PTSD Symptoms from the PSS-SR	PTSD Models	
	(DSM-5)	(DSM-5-Dysphoria)
B1: Intrusive Thoughts	RE	RE
B2: Nightmares	RE	RE
B3: Flashbacks	RE	RE
B4: Emotional Cue Reactivity	RE	RE
B5: Physiological Cue Reactivity	RE	RE
C1: Avoidance of Thoughts	AV	AV
C2: Avoidance of Reminders	AV	AV
D1: Memory Impairment	NAMC	D
D2: Negative Beliefs	NAMC	D
D3: Distorted Blame	NAMC	D
D4: Persistent Negative Emotional States	NAMC	D
D5: Lack of Interest	NAMC	D
D6: Feeling Detached	NAMC	D
D7: Inability to Experience Positive Emotions	NAMC	D
E1: Irritable/Angry	AR	D
E2: Reckless Behavior	AR	H
E3: Hypervigilance	AR	H
E4: Easily Startled	AR	H
E5: Difficulty Concentrating	AR	D
E6: Difficulty Sleeping	AR	D

Note. RE= Re-experiencing, AV = Avoidance, NAMC = Negative Alterations in Mood and Cognitions, AR = Alterations in Arousal and Re-activity; H = Hyperarousal, D = Dysphoria.

Table 2.

DES Item Distribution across Dissociative Models.

DES items	DES Models			
	(1-factor model)	(2-factor model)	(3-factor model)	(4-factor model)
1: Forgot bus or car journey	D	AB	AB	DST
2: Did not hear a conversation	D	AB	AB	DST
3: Found in a place with no idea how you got there	D	AMN	AMN	AMN
4: Found dressed in clothes that you don't remember putting on	D	AMN	AMN	AMN
5: Found new things that you did not remember buying	D	AMN	AMN	AMN
6: Approached by strangers	D	AMN	AMN	AMN
7: Standing next to yourself / watching yourself	D	AMN	DEP	DEP
8: Not recognizing friends or family	D	AMN	AMN	AMN
9: No memory for important events	D	AMN	AMN	AMN
10: Accused of lying	D	AB	AB	DEP
11: No self-recognition in irror	D	AMN	DEP	DEP
12: Feeling other people, objects, and the world are not real	D	AMN	DEP	DEP
13: Feeling your body does not belong to you	D	AMN	DEP	DEP
14: Sometimes remembering a past event so vividly	D	AB	AB	AB
15: Not knowing whether things you remember happened	D	AB	AB	DST
16: Finding a familiar place strange and unfamiliar.	D	AB	AB	DEP
17: Completely absorbed in a story	D	AB	AB	AB
18: So involved in a fantasy /daydream it seems real	D	AB	AB	AB
19: Able to ignore pain	D	AB	AB	AB
20: Staring off into space, thinking of nothing, and unaware of time	D	AB	AB	AB
21: Talking out loud to yourself	D	AB	AB	DST
22: Acting differently across situations	D	AB	AB	ABS
23: Able to do things with amazing ease and spontaneity	D	AB	AB	AB
24:Cannot remember whether you have done something	D	AB	AB	DST
25: Evidence that you have done things that you do not remember	D	AB	AB	DST
26: Found writings, drawings, or notes that you cannot remember doing	D	AB	AB	DST
27: Heard voices telling you to do things	D	AMN	DEP	DEP
28: Looking at the world through a fog	D	AMN	DEP	DEP

Note. D = dissociation, AB = absorption, AMN = amnesia, DEP = depersonalization/derealization, DST = distractibility.

Table 3.

Trauma endorsement of the effective sample (N=165)

Trauma Experience	**Frequency (%)**
Death of a close friend or family member	79 (47.9)
Physical violence	55 (33.3)
Sexual assault	45 (27.3)
Present when another was killed, injured, physically or sexually assaulted (excluding when this was on TV)	46 (27.9)
Life-threatening accident	38 (23.0)
Extreme exposure to gruesome or horrifying details of another person's death, serious injury, or sexual violation (excluding if only on TV but allowing if in a work role).	38 (23.0)
Physical maltreatment	29 (17.6)
Life-threatening illness	27 (16.4)
Attempted rape	25 (15.2)
Threatened with a weapon	23 (13.9)
Rape	19 (11.5)
Serious life danger e.g. military combat / living in a war zone.	10 (6.1)
Physical force or a weapon used against you in a robbery or mugging	8 (4.8)

Note. Trauma endorsements are not mutually exclusive.

Table 4.

Fit indices for competing PSS Models.

Fit Statistics	DSM-5 Dysphoria	**DSM-5 Numbing**
Chi-Square	χ^2 (164) = 323.900	**χ^2 (164) = 317.964**
RMSEA	.077	**.075**
CFI	.969	**.970**
TLI	.964	**.965**
BIC	7200.522*	**7201.190***

Note. RMSEA = Root Mean Square Error of Approximation, CFI = Comparative Fit Index, TLI = Tucker Lewis Index, BIC = Bayesian Information Criteria.

Table 5.

Fit indices for competing DES Models.

	DES – 1 factor	DES – 2 factor	**DES – 3 factor**	DES – 4 factor
Fit Statistics	χ^2 (350) = 797.310	χ^2 (349) = 760.874	**χ^2 (347) = 727.020**	χ^2 (344) = 733.587
Chi-Square	.088 (.080-.096)	.085 (.076-.093)	**.081 (.073-.090)**	.083 (.075-.091)
RMSEA	.697	.721	**.743**	.736
CFI	.673	.698	**.720**	.710
TLI	19001.691	18923.890	**18863.281**	18894.181
BIC				

Note. RMSEA = Root Mean Square Error of Approximation, CFI = Comparative Fit Index, TLI = Tucker Lewis Index, BIC = Bayesian Information Criteria.

Table 6.

Wald's chi-square test of parameter constraints comparing the relation between each PTSD factor with factors of Dissociation

Correlated factors	***r***	**Correlated factors**	***r***	**Wald test (p)**
Re with AB	.432	Re with AMN	.242	12.664 (.000)*
Re with AB	.432	Re with DEP	.327	2.703 (.100)
Re with AMN	.242	Re with DEP	.327	1.58 (.209)
AV with AB	.397	AV with AMN	.305	2.257 (.133)
AV with AB	.397	AV with DEP	.289	2.514 (.113)
AV with AMN	.305	AV with DEP	.289	0.045 (.833)
NAMC with AB	.386	NAMC with AMN	.267	4.656 (.031)
NAMC with AB	.386	NAMC with DEP	.377	0.028 (.867)
NAMC with AMN	.267	NAMC with DEP	.377	2.793 (.095)
AR with AB	.462	AR with AMN	.302	7.776 (.005)*
AR with AB	.462	AR with DEP	.432	.270 (.604)
AR with AMN	.302	AR with DEP	.432	3.306 (.069)

Note. R= Re-experiencing, AV = Avoidance, NAMC = Negative Alterations in Mood and Cognitions, AR = Alterations in Arousal and Reactivity; AB = Absorption, AMN = Amnesia, DEP = Depersonalization/Derealization. All correlations were significant (p<.001). Significantly different correlated pairs (p, <.01) are highlighted by *.

Table 7.

Wald's chi-square test of parameter constraints comparing Depersonalization/Derealization across PTSD factors

Correlated factors	***r***	**Correlated factors**	***r***	**Wald test (p)**
DEP with RE	.327	DEP with AV	.289	.856 (.355)
DEP with RE	.327	DEP with NAMC	.377	1.838 (.175)
DEP with RE	.327	DEP with AR	.432	5.853 (.016)
DEP with AV	.289	DEP with NAMC	.377	4.458 (.035)
DEP with AV	.289	DEP with AR	.432	8.352 (.004)*
DEP with NAMC	.377	DEP with AR	.432	2.480 (.115)

Note. RE= Re-experiencing, AV = Avoidance, NAMC = Negative Alterations in Mood and Cognitions, AR = Alterations in Arousal and Reactivity; DEP = Depersonalization/Derealization. All correlations were significant (p<.001). Significantly different correlated pairs (p, <.01) are highlighted by *.